



GreenDIGIT

The 6Green Observability Framework

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Environmental Sustainability in 6G

Renewed interest in addressing global and local **societal challenges**.



Being 6G the upcoming generation of mobile technologies, it is of paramount importance to ensure a **value-driven approach** is adopted since the get-go.



Sustainable 6G: to ensure that this generation will be more efficient than its predecessor, **technological enablers** are needed **across the edge-cloud continuum**



6G for Sustainability: enabling sustainability for strategic verticals can in turn generate a **ripple effect** to other neighbouring markets.



An **ethical network** is not possible unless it is a **fair network**: where the as-a-Service paradigm has failed so far, is in its inability to truly identify the actual resource **usage ascribable** to a vertical application or a network slice.

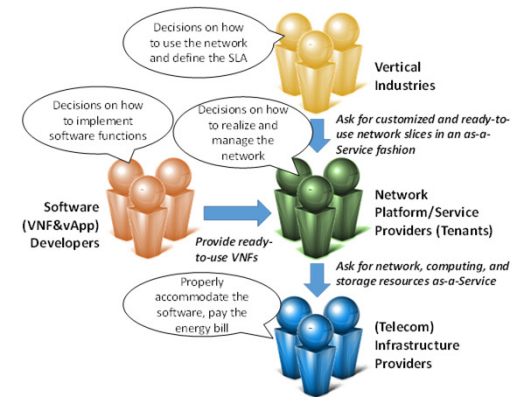


Environmental Sustainability in 6G - Issues

The widespread of **edge-cloud continuum** requires a tight interplay between networking and computing technologies

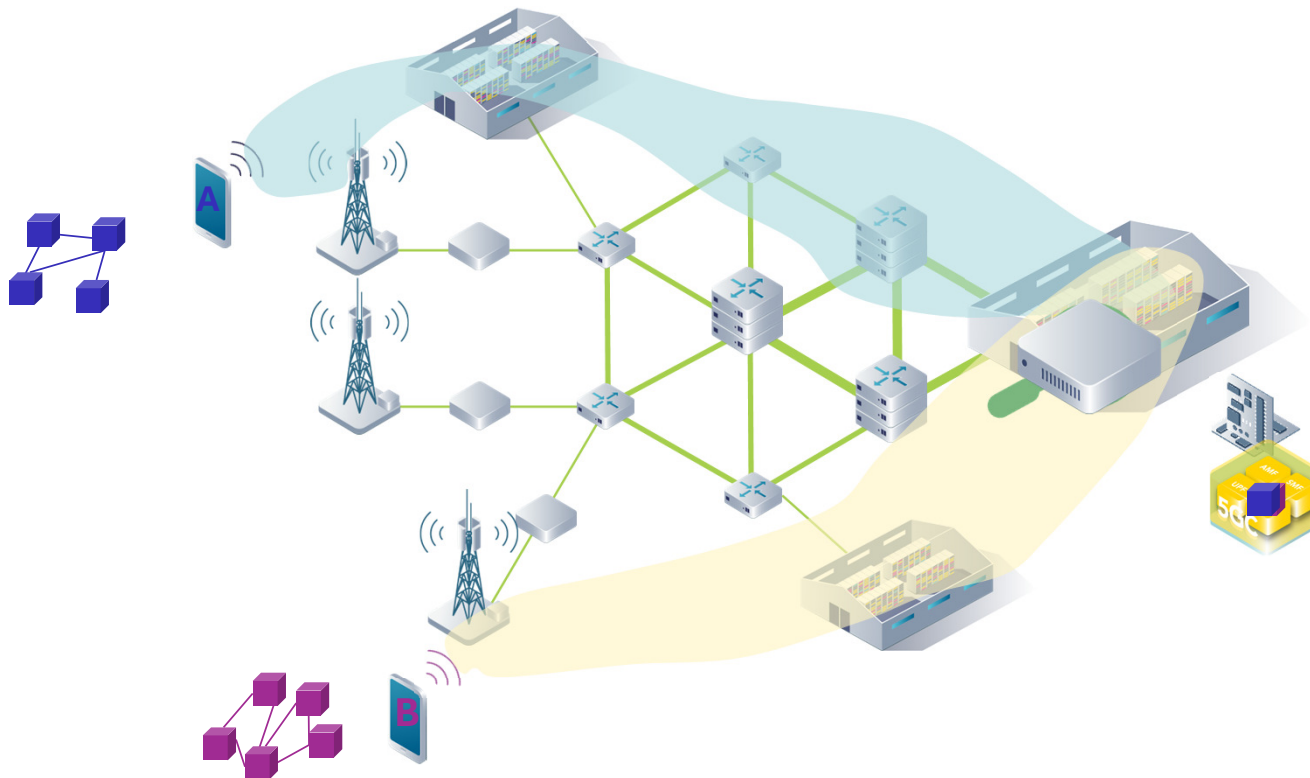
Technical and commercial synergies must be put into place among several, **very diverse stakeholders** whose targets may not be aligned and, in some cases, may even be competing

Only the stakeholders possessing the physical components have the visibility of the actual consumed energy and an economic interest in its reduction, but such energy is **ascribable to the virtual instances** running on top of the hardware



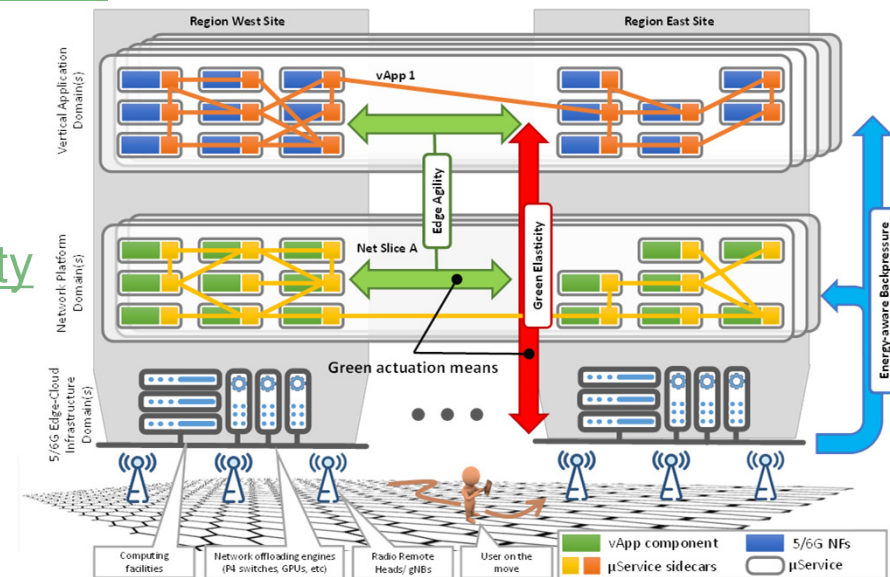


Environmental Sustainability in 6G - Issues



The 6Green Project

- Objective: promote energy efficiency across the whole **5/6G value-chain** and enable **5/6G networks and vertical applications** to reduce their carbon footprint by a factor of 10 or more.
- How? Exploit and extend state-of-the-art **cloud-native technologies and the B5G SBA** with new cross-domain enablers to:
 - boost the global ecosystem flexibility, scalability and sustainability
 - enable all the **5/6G stakeholders** reducing their carbon footprint by becoming integral parts of a win-win green-economy business.

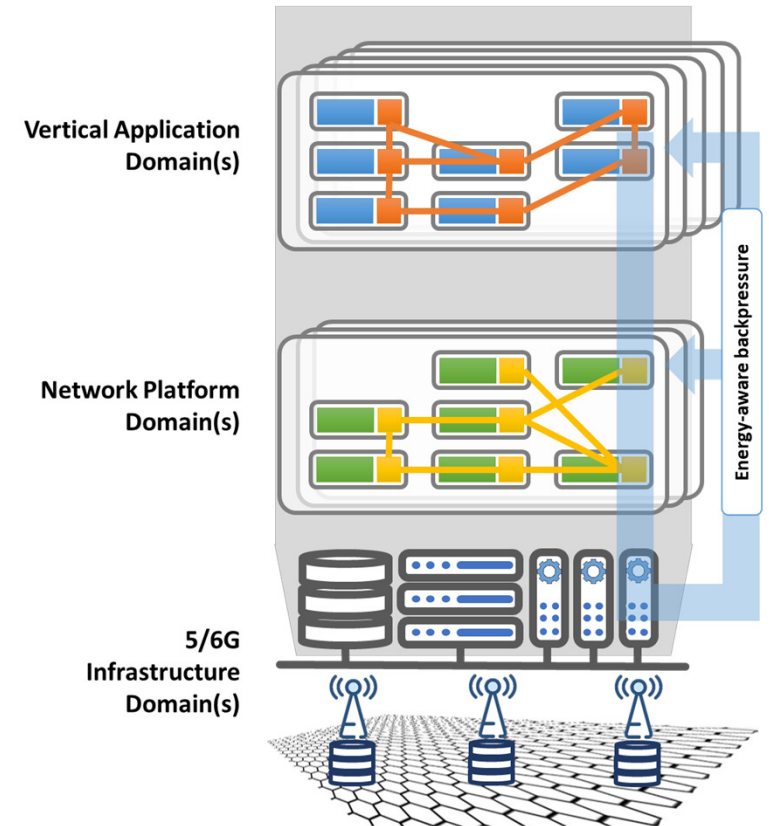




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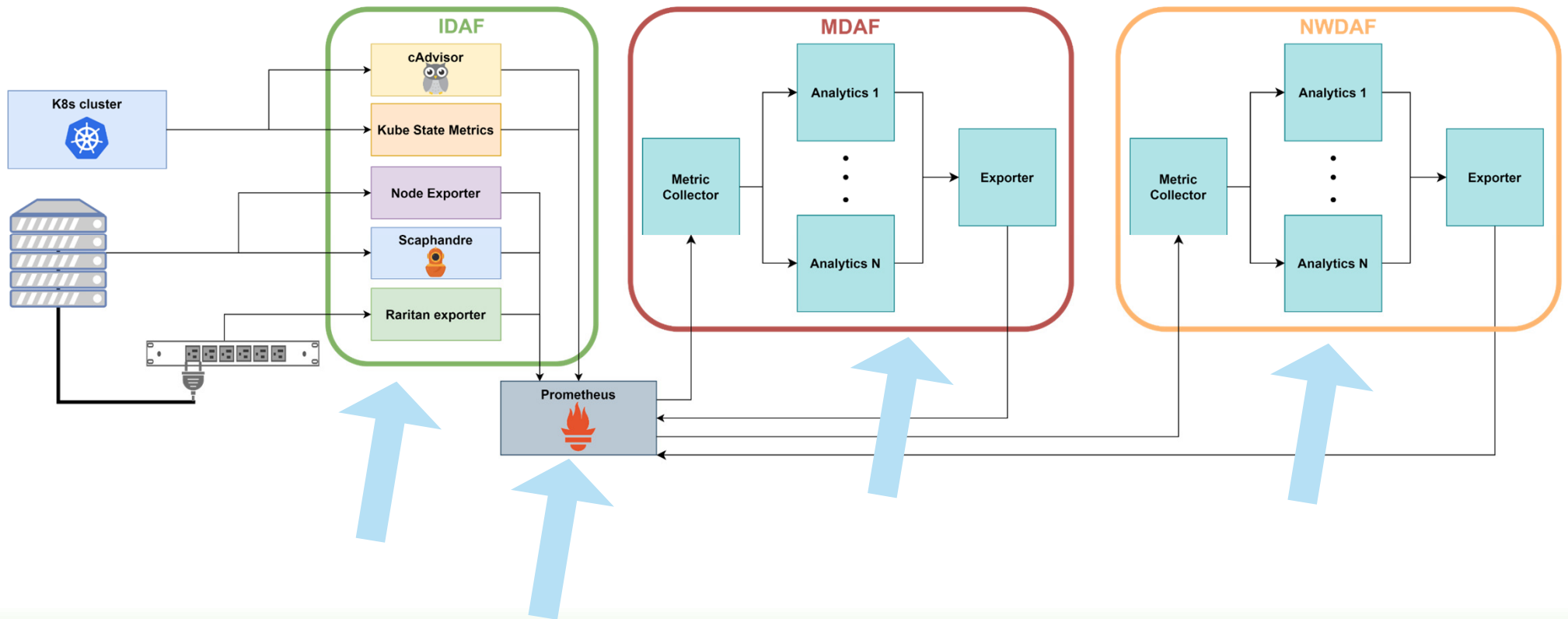
Energy-Aware Backpressure

- A set of **cross-domain observability** mechanisms and **analytics** to evaluate the energy and the carbon footprint that a vertical application, a slice, or the overall 5/6G network **induce onto the edge-cloud infrastructure**.
- Suitably **process, infer, and expose** this information at both the 5/6G SBA and vertical application (and their network slices) levels thanks to an extended SBA.
- **Win-win-business models** to promote sustainable behaviors in the scope of a **Decarbonization Level Agreement**.



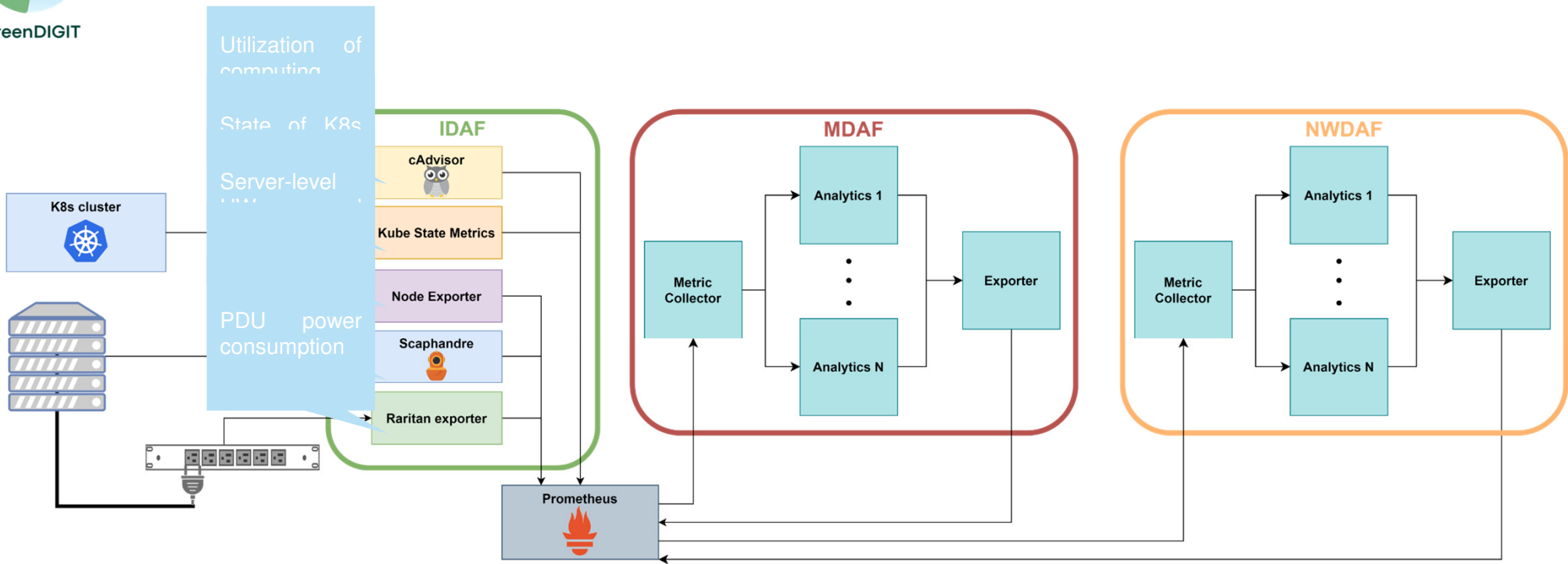


The 6Green Observability Framework



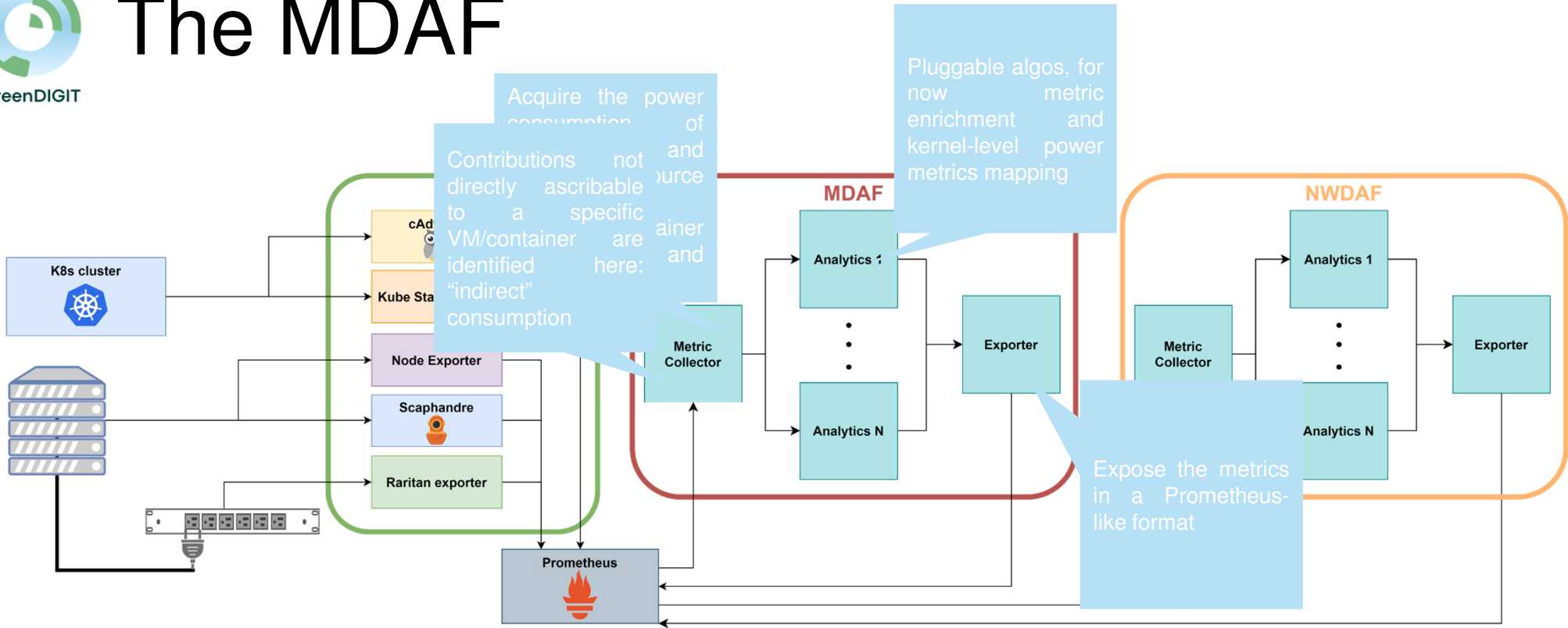


The IDAF





The MDAF

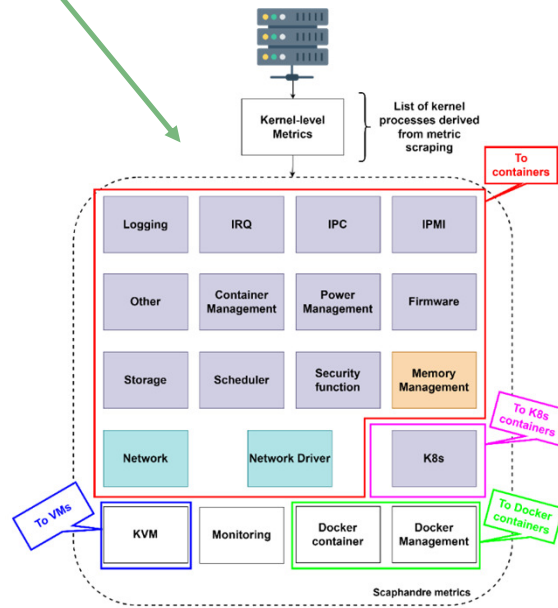




The MDAF

Container consumption+”indirect” consumption

Intel
RAPL



Algorithm 2 Mapping of kernel-level power according to resource utilization

$r_i =$ Get CPU utilization per container from *cAdvisor*
 $total_cpu_utilization = 0$

$\forall i \in r_1:$
 $total_cpu_utilization += r_i$

$\forall x_i \in K:$
 $\% = r_i / total_cpu_utilization$
 $x_i += \% \cdot category_power_cons$

$\forall x_i \in D:$
 $\% = r_i / total_cpu_utilization$
 $x_i += \% \cdot category_power_cons$
